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CLAIMS

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[Claim(s)]

[Claim 1] The member made from a Magnesium alloy excellent in the setting-proof nature in the pressurization section characterized by consisting of the remainder Mg and an impurity aluminum:1.5-10.0% by weight % including less than [ RE:2.5% ] and calcium:0.2-5.5%.

[Claim 2] calcium: The member made from a Magnesium alloy excellent in the setting-proof nature in the pressurization section according to claim 1 which is 0.25-5.5%.

[Claim 3] aluminum: The member made from a Magnesium alloy excellent in the setting-proof nature in the pressurization section according to claim 1 which are 2.0-8.0%, RE:0.5-2.0%, and calcium:0.5-4.0%.

[Claim 4] The member made from a Magnesium alloy excellent in the tractive characteristics characterized by consisting of the remainder Mg and an impurity aluminum:1.5-10.0% by weight % including one sort in less than [ RE:2.5% ], calcium:0.2-5.5%, and Cu and Zn, or : [ two sorts of ] 0.2 - 2.5%, and the setting-proof nature in the pressurization section.

[Claim 5] aluminum: The member made from a Magnesium alloy excellent in the tractive characteristics according to claim 4 which are 2.0-8.0%, RE:0.5-2.0%, and calcium:0.2-4.0%, and the setting-proof nature in the pressurization section.

[Claim 6] The setting-proof nature in the pressurization section is the member made from a Magnesium alloy excellent in the setting-proof nature in the pressurization section according to claim 1 to 5 which is the heat-resistant setting nature in an elevated temperature.

[Claim 7] The member made from a Magnesium alloy the pressurization section excelled [ member ] in the setting-proof nature in the pressurization section according to claim 1 to 6 which is the bolt conclusion section.

## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the member made from a Magnesium alloy which should be excellent in the setting-proof nature, especially the heat-resistant setting nature in the bolt conclusion section in the components made from a Magnesium alloy which have, the pressurization section, for example, the bolt conclusion section, especially used by hot environments, about the lightweight member made from a Magnesium alloy used as the components, for example, the components for automobiles, of the machine structure.

[0002]

[Description of the Prior Art] As a Magnesium alloy used for the material of the components for automobiles, conventionally For example, JIS H The alloy for magnesium castings (MC 1 - MC10) enacted by 5203, and JIS H Although there is an alloy for magnesium die casting (MD 1A, MD 1B) enacted by 5303 As a Magnesium alloy which was excellent in the material property under hot environments especially, there is AE42 material (U.S. Dow Chemical) which is a Mg-4%aluminum-2%RE (rare earth elements) system alloy.

[0003]

[Problem(s) to be Solved by the Invention] In however, the case of the components which used as a material AE42 material which is such a Mg-4%aluminum-2%RE (rare earth elements) system alloy When distribution of Ce compound considered to contribute at improvement in the setting-proof nature of the bolt conclusion section, especially heat-resistant setting nature in the case of the components which have especially the bolt conclusion section, and generation do not take the coagulation gestalt by quenching like die casting It was a technical problem for there to be a trouble that sufficient heat-resistant setting nature cannot be obtained, and to solve such a trouble.

[0004]

[Objects of the Invention] This invention is made in view of such a conventional technical problem. Also including the case where the coagulation gestalt by such quenching besides in the case of taking the coagulation gestalt by quenching like die casting is not taken, even if it is the casting approach of what kind of cooling rate It aims at offering the member made from a Magnesium alloy excellent in the heat-resistant setting nature in the pressurization sections, such as setting-proof nature

in the pressurization sections, such as the bolt conclusion section, especially the hot bolt conclusion section. While excelling in the setting-proof nature in the pressurization section depending on the case, it aims at offering the member made from a Magnesium alloy which can also raise the tractive characteristics in ordinary temperature further again.

[0005]

[Means for Solving the Problem] The member made from a Magnesium alloy excellent in the setting-proof nature in the pressurization section concerning this invention By adding a minute amount or little calcium, while reducing the content of RE in a Mg-aluminum-RE system alloy Even if it is the casting approach of what kind of cooling rate, it enables it to raise the setting-proof nature in the pressurization sections, such as the bolt conclusion section. By weight % aluminum: It is characterized by considering as the component presentation which consists of the remainder Mg and an impurity 1.5-10.0% including less than [ RE(one sort or two sorts or more of rare earth elements):2.5% ], and calcium:0.2-5.5%.

[0006] Similarly moreover, the member made from a Magnesium alloy excellent in the tractive characteristics concerning this invention, and the setting-proof nature in the pressurization section Cu and Zn of a minute amount enable it to raise the tractive characteristics in ordinary temperature simultaneous adding or by carrying out independent addition to the above-mentioned member made from a Magnesium alloy. By weight % aluminum: It is characterized by considering as the component presentation which consists of the remainder Mg and an impurity 1.5-10.0% including one sort in less than [ RE:2.5% ], calcium:0.2-5.5%, and Cu and Zn, or : [ two sorts of ] 0.2 - 2.5%.

[0007] And in the embodiment of the member made from a Magnesium alloy by this invention, it is the heat-resistant setting nature near [ the temperature of 100 degrees C to ] 150 degree C, and setting-proof nature in the pressurization section is characterized by excelling in such heat-resistant setting nature, and the pressurization section is the bolt conclusion section and it is characterized by excelling in the setting-proof nature, especially the heat-resistant setting nature in such the bolt conclusion section.

[0008] Next, the reason for limitation of a component presentation (% of the weight) of the member made from a Magnesium alloy excellent in the setting-proof nature in the pressurization section concerning this invention is explained.

[0009] aluminum:1.5 - 10.0% drawing 1 is what shows the result of having investigated the effect of aluminum content exerted on the tractive

characteristics of the Magnesium alloy whose RE content is 0.9 - 1.2%. Moreover, drawing 2 The effect of aluminum content exerted on the heat-resistant setting nature in the bolt conclusion section in the elevated temperature (100 degrees C) of the Magnesium alloy whose RE contents are 0%, 1.0%, and 2.0% is set in the next example. As the result investigated by measuring an axial-tension decreasing rate in the way shown in adopted drawing 5 (A) and (B) is shown and it is shown in drawing 2 , although aluminum content serves as min, the heat setting (axial-tension decreasing rate) of the bolt conclusion section near 4.0% If tension strength serves as max at about 6% and aluminum content becomes less than about 6% as shown in drawing 1 , tension strength will fall, and it falls further at 4.0% or less, and becomes less practical at less than 1.5%.

[0010] And although tension strength will show the inclination of an increment to about 6% and proof stress will also increase it to 10.0% if aluminum content is made to increase, tension strength falls rather. Moreover, as for this inclination, RE content was checked in 2.5% or less of range. Therefore, since it is such, aluminum content is more preferably good to consider as 2.0 - 8.0% of range 1.5 to 10.0%.

[0011] RE(one sort or two sorts or more of sum totals chosen from among rare earth elements): It was checked that less than [ 2.5% ] RE has the large effectiveness that the direction which makes [ many ] an addition improves the heat-resistant setting nature in the pressurization sections, such as the bolt conclusion section in an elevated temperature. And when it is made to contain 2.0% or more, in order to make Ce compound considered to contribute to improvement in the heat-resistant setting nature in the pressurization sections, such as the bolt conclusion section, distribute and generate, it is necessary to use the casting approach of taking the coagulation gestalt by quenching like die casting. Of course, in this invention, since it is possible, using die casting makes RE content 2.5% or less.

[0012] Therefore, as for RE content, being added at 2.0% or less is desirable, and it is the optimal. [ about 1.0% of ] Moreover, finally, while the yield worsened at 2.0% or more, abundant addition of RE has checked the effectiveness of improving the heat-resistant setting nature in the pressurization sections, such as the bolt conclusion section in an elevated temperature, even if cost added a minute amount or little calcium further, after adding RE 2.0% or more, although it became high. It is good to make the content of RE into 0.5 - 2.0% of range more preferably 2.5% or less for such a reason.

[0013] calcium:0.2 - 5.5% drawing 3 is what shows the result of having investigated the effect of calcium content exerted on the tractive characteristics of the Magnesium alloy whose RE content is 0.9 - 1.2%. Moreover, drawing 4 The effect of calcium content exerted on the heat-resistant setting nature in the bolt conclusion section in the elevated temperature (100 degrees C) of the Magnesium alloy whose RE contents are 1.0% and 2.0% is set in the next example. Although the heat-resistant setting nature of the bolt conclusion section in an elevated temperature is improved even if calcium is the case where little addition is carried out, as the result investigated by measuring an axial-tension decreasing rate in the way shown in adopted drawing 5 (A) and (B) is shown and it is shown in drawing 4 , the property seldom improves at less than 0.2%. Since it will become that in which toughness (elongation) is inferior and will also come to generate a casting crack at the time of casting if it exceeds 5.5% as shown in drawing 3 , it becomes and less practical, although the property which the heat-resistant setting nature of the bolt conclusion section in an elevated temperature improves further, and is most improved at 0.50 - 0.75% is shown, it exceeds 1% and the effectiveness is shown even about 6%, when calcium content is made to increase further. Moreover, as for this inclination, RE content was checked in 2.5% or less of range. Therefore, since it is such, it is good to make the content of calcium into 0.2 - 4.0% of range more preferably 0.2 to 5.5%.

[0014] In order to raise the tractive characteristics of the member made from a Magnesium alloy in ordinary temperature when [ of Cu and the Zn / one sort or when Cu and Zn have few calcium contents : / two sorts of / 0.2 to 2.5% ], it is the element which can be added suitably, when compound-adding or independent adding in 0.2 - 2.5% of range, the effectiveness is demonstrated, but since the effectiveness is lost in excess 2.5%, it is good to consider as 0.2 - 2.5% of range. Moreover, the same thing can say also from the heat-resistant setting nature evaluation in the 150-degree C bolt conclusion section.

[0015] The member made from a Magnesium alloy which has the pressurization sections, such as the bolt conclusion section which has such a component presentation, can be manufactured by the dissolution of the common components for the automobiles made from a Magnesium alloy, and the casting approach.

[0016] For example, the crucible made from steel which does not contain nickel component is used, and the gas for antioxidizing represented by the mixed gas of SF<sub>6</sub> / CO<sub>2</sub>/Air can be used, and it can dissolve and cast.

[0017] Moreover, the member made from a Magnesium alloy which has the

pressurization sections, such as the bolt conclusion section concerning this invention, can adopt various kinds of casting approaches, for example, a sand cast method, metal mold casting, pressure die casting, plaster mold casting, etc., and especially limitation is not carried out.

[0018]

[Function of the Invention] The member made from a Magnesium alloy which has the pressurization sections, such as the bolt conclusion section by this invention While consisting of a component presentation of Remainder Mg and an impurity and reducing RE content aluminum:1.5-10.0% by weight % including less than [ RE:2.5% ] and calcium:0.2-5.5% Since it is what adds a minute amount or little calcium, it is what Ce compound crystallized with the gestalt which followed the gap of a dendrite. This made the skid hard to generate in the case of deformation, and the heat-resistant setting nature in the pressurization section has been improved in the setting-proof nature in the pressurization section, especially an elevated temperature. Moreover, when the property in 100 degrees C - 150 degrees C is excellent, it cannot be overemphasized that it is the property of excelling also in the temperature exceeding 150 degrees C.

[0019] Moreover, the member made from a Magnesium alloy which similarly has the pressurization sections, such as the bolt conclusion section by this invention In the member made from a Magnesium alloy concerning the above-mentioned invention, further, since one sort in Cu and Zn or two sorts are made to contain 0.2 to 2.5% in total While the heat-resistant setting nature in the pressurization section is improved in the setting-proof nature in the pressurization section, especially an elevated temperature, the tractive characteristics in ordinary temperature serve as a member made from a Magnesium alloy which has the pressurization sections, such as the bolt conclusion section which improved further.

[0020] Moreover, RE (rare earth elements) which is an alloy element To enable it to reduce the addition, since it is expensive, without reducing the heat-resistant setting nature in the pressurization section in the setting-proof nature in the pressurization sections, such as the bolt conclusion section, especially an elevated temperature is desired. In this invention, even when RE content is reduced, it becomes the setting-proof nature in the pressurization sections, such as the bolt conclusion section, especially the thing in which the heat-resistant setting nature in the pressurization section was excellent in the elevated temperature, and low cost-ization is also brought about by expensive addition reduction of RE.

[0021]

[Example] Hereafter, the example of the member made from a Magnesium alloy which was excellent in the setting-proof nature in the pressurization section concerning this invention is shown.

[0022] Although it could manufacture by the dissolution of the common components for the automobiles made from a Magnesium alloy, and the casting approach, the crucible made from steel which does not contain nickel component was used for the member made from a Magnesium alloy which has the pressurization sections, such as the bolt conclusion section concerning this invention, the gas for antioxidizing which uses the mixed gas of SF<sub>6</sub> / CO<sub>2</sub>/Air as a principal component was used for it, and it dissolved and cast it in this example.

[0023] The analysis result of the alloy content of 38 kinds (examples 1-23, examples 1-15 of a comparison) of casts ingoted, cast and manufactured is shown in Table 1 thru/or 3. Subsequently, the piece of the tensile test made from a Magnesium alloy and the member made from a Magnesium alloy for heat-resistant setting nature measurement are created from these castings, and it is JIS. Z 2201 and JIS Z The heat-resistant setting sex test by the point shown in the tensile test based on 2241, drawing 5 (A), and (B) was performed.

[0024] It changes into the condition of having put in order the member 1 made from a Magnesium alloy for heat-resistant setting nature measurement which makes the shape of a cylindrical shape as shown in drawing 5 (A), and the different-species member (product made from steel) 2 which similarly makes the shape of a cylindrical shape in this heat-resistant setting sex test. As washers 3 and 4 are applied to both ends and it is indicated in drawing 5 (B) as the case where it binds tight with a bolt 5 and a nut 6 The shape of a cylindrical shape is made into nothing and the condition of having piled up the different-species member (product made from steel) 12 which formed female screw 12a in inner circumference, as well as the member 11 made from a Magnesium alloy for heat-resistant setting nature measurement which makes the shape of a cylindrical shape. About the case where applied the washer 13 to the member 11 made from a Magnesium alloy, and thrust the bolt 15 into female screw 12a, and it is bound tight The axial-tension decreasing rate at the time of bolting with bolts 5 and 15 estimated heat-resistant setting nature, and the 150-degree C trial was carried out with the retention temperature of 100 degrees C in this case for predetermined axial-tension 30MPa, and holding-time 200 hours. In addition, in this conclusion section, the electric corrosion prevention approach generally used can also be used.

[0025] thus -- a tensile test -- obtaining -- having had -- tension -- strength -- proof stress -- elongation -- a table -- four -- or -- a table -- six -- " -- tension -- strength -- " -- " -- proof stress -- " -- " -- elongation --] -- a column -- being shown -- a result -- it was . Moreover, it was the result of similarly showing the heat-resistant setting nature evaluation (axial-tension decreasing rate) obtained by the heat-resistant setting sex test in Table 4 thru/or 6.

[0026]

[Table 1]

区分	化学成分 (重量%)							備考
	A l	M n	R E	C a	C u	Z n	M g	
実施例 1	2. 0	0. 3 8	0. 9 0	0. 3 2	—	—	残部	
実施例 2	4. 1	0. 2 9	1. 1	0. 3 1	—	—	残部	
実施例 3	5. 9	0. 3 2	1. 2	0. 3	—	—	残部	
実施例 4	9. 4	0. 2 5	1. 0	0. 2 9	—	—	残部	
実施例 5	1. 9	0. 3 9	0. 9 0	1. 0	—	—	残部	
実施例 6	4. 0	0. 3 5	1. 1	0. 9 0	—	—	残部	
実施例 7	6. 1	0. 3 2	1. 2	1. 1	—	—	残部	
実施例 8	9. 5	0. 2 6	1. 1	1. 0	—	—	残部	
実施例 9	2. 0	0. 4 2	0. 9 0	3. 0	—	—	残部	
実施例 1 0	4. 2	0. 3 5	0. 9 0	3. 1	—	—	残部	
実施例 1 1	5. 9	0. 3 1	1. 1	3. 2	—	—	残部	
実施例 1 2	9. 3	0. 2 8	1. 0	3. 0	—	—	残部	

[0027]

[Table 2]

[0028]

[Table 3]

[0029]

[Table 4]

[0030]

[Table 5]

[0031]

[Table 6]

[0032] While mechanical properties, such as proof stress and elongation, were good in tension strength, by the member made from a Magnesium alloy of this invention example, it was admitted that the axial-tension decreasing rate was small and it had become the temperature of 100 degrees C and the thing excellent in the heat-resistant setting nature of the 150-degree C bolt conclusion section, so that more clearly than the



result shown in Table 1 thru/or 6.

[0033] On the other hand, in the member made from a Magnesium alloy of the example of a comparison with which are not satisfied of this invention, while there were some which were inferior to mechanical properties, such as proof stress and elongation, in tension strength, the axial-tension decreasing rate is what shows a large value, and was inferior to the heat-resistant setting nature of the temperature of 100 degrees C, and the 150-degree C bolt conclusion section.

[0034]

[Effect of the Invention] The member made from a Magnesium alloy concerning this invention is weight %. aluminum:1.5-10.0%, Depending on the case, less than [ RE:2.5% ] and calcium:0.2-5.5% further Since it has the component presentation which consists of the remainder Mg and an impurity including one sort in Cu and Zn, or : [ two sorts of ] 0.2 - 2.5% Even if it is the case where the casting approaches used as what kind of cooling rate also including the case where the coagulation gestalt by such quenching besides in the case of taking the coagulation gestalt by quenching like die casting is not taken are adopted It is possible to have excelled in the heat-resistant setting nature in the pressurization sections, such as setting-proof nature in the pressurization sections, such as the bolt conclusion section, especially the hot bolt conclusion section. The effectiveness it is ineffective work size of becoming possible to maintain the good conclusion condition by conclusion means, such as a bolt, over a long period of time is brought about.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the graph which shows the result of having investigated the effect of aluminum content exerted on the tractive characteristics of the Magnesium alloy whose RE content is 0.9 - 1.2%.

[Drawing 2] It is the graph which shows the result of having investigated the effect of aluminum content exerted on the heat-resistant setting nature (axial-tension decreasing rate) in the bolt conclusion section in the elevated temperature (100 degrees C) of the Magnesium alloy whose RE contents are 0%, 1.0%, and 2.0%.

[Drawing 3] It is the graph which shows the result of having investigated the effect of calcium content exerted on the tractive characteristics of the Magnesium alloy whose RE content is 0.9 - 1.2%.

[Drawing 4] It is the graph which shows the result of having investigated

the effect of calcium content exerted on the heat-resistant setting nature (axial-tension decreasing rate) in the bolt conclusion section in the elevated temperature (100 degrees C) of the Magnesium alloy whose RE contents are 1.0% and 2.0%.

[Drawing 5] It is the cross-section explanatory view showing the structure of the bolt conclusion section adopted in the example of this invention.